R E P O R T R E S U M E S

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PROGRAMMED MATERIALS IN HIGH SCHOOL CORRESPONDENCE COURSES.

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DESCRIPTORS- PROGRAMED TEXTS, *PROGRAMED INSTRUCTION, PROGRAMED MATERIALS, *CORRESPONDENCE COURSES, DROPOUT RATE, *HIGH SCHOOL STUDENTS, *MATERIAL DEVELOPMENT, *ACHIEVEMENT, ENGLISH, ALGEBRA, TEMAC ALGEBRA, SEATTLE ALGEBRA TEST, IOWA TEST OF EDUCATIONAL DEVELOPMENT, HENMON NELSON TEST OF MENTAL ABILITY, ENGLISH 2600 PROGRAM, LINCOLN, NEBRASKA

THE PURPOSE WAS TO DETERMINE IF MATERIALS CONSTRUCTED ACCORDING TO PROGRAMING PRINCIPLES WOULD BE RELATED TO ACHIEVEMENT, COMPLETION TIME, AND DROPOUT RATE IN CORRESPONDENCE STUDY. THREE METHODS WERE USED IN ADMINISTERING THE NINTH-GRADE LEVEL TEMAC ALGEBRA PROGRAM AND THE ENGLISH 2600 PROGRAM. SUPPLEMENTARY PROGRAMED MATERIALS WERE PREPARED AND TRIED OUT WITH SAMPLE EIGHTH- AND NINTH-GRADE STUDENTS. THE FIRST METHOD WAS A COURSE BUILT AROUND A COMMERCIAL PROGRAMED TEXT. THE SECOND WAS THE USE OF SHORT PROGRAMS TO SUPPLEMENT THE PRESENT COURSE MATERIALS. THE THIRD METHOD USED THE REGULAR CORRESPONDENCE MATERIALS USED AT THE UNIVERSITY OF NEBRASKA. THE SAMPLE POPULATIONS NUMBERED 186 STUDENTS FOR ALGEBRA AND 191 FOR ENGLISH. PRETESTS OF MENTAL ABILITY AND COURSE MATERIALS WERE GIVEN AT THE TIME OF REGISTRATION. THE SAMPLE POPULATION WAS COMPARED WITH A PREVIOUS NINTH-GRADE POPULATION FOR AGE, SEX, FATHER'S OCCUPATION, AND ADDRESS. THE ALGEBRA COURSE HAD 85 COMPLETIONS WITH 131 COMPLETING THE FIRST 4 UNITS OF ENGLISH IN THE ALLOTTED TIME. THE RESULTS SHOWED THAT (1) THERE WAS NO DIFFERENCE AMONG THE METHODS IN EITHER SUBJECT ON THE CRITERION TEST MEANS, (2) THE DROPOUT RATE OF STUDENTS WAS NOT SIGNIFICANTLY DIFFERENT AMONG THE METHODS IN EITHER OF THE SUBJECTS, (3) THE ALGEBRA STUDENTS WHO USED PROGRAMED MATERIALS PRIMARILY COMPLETED THE COURSE NEARLY 2 MONTHS EARLIER THAN THOSE USING THE OTHER TWO METHODS, (4) A SIGNIFICANT RELATIONSHIP WAS OBTAINED BETWEEN PRETEST SCORES AND CRITERION SCORES IN ALL GROUPS OF BOTH COURSES, (5) NO SIGNIFICANT RELATIONSHIPS WERE OBTAINED BETWEEN COMPLETION TIME AND HENMON-NELSON SCORES, (6) COMPLETERS IN BOTH SUBJECTS HAD SIGNIFICANTLY HIGHER HENMON-NELSON MEANS AND PRETEST MEANS THAN DID DROPOUTS, AND (7) GIRLS SHOWED A GREATER TENDENCY TO COMPLETE THAN BOYS. (HB)

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Chapter I

NATURE OF THE STUDY

Correspondence study is an educational technique that has been used for several years in countries such as the United States, Australia, Canada, Sweden, New Zealand, and the Soviet Union. The uses of correspondence study are varied. Students who live in isolated areas often obtain their complete formal elementary and secondary education by correspondence, small schools use correspondence courses to broaden their curricula, adults complete their secondary education with correspondence courses and continue with college work (including graduate work) by correspondence, handicapped individuals make wide use of correspondence courses, and vocational training is obtained through correspondence. The above are some of the common uses of correspondence study. Many other uses could be cited, but the point is that the correspondence course is a significant medium of education.

Before going further, a distinction should be made between correspondence study and supervised correspondence study. In both of these, the student obtains study materials from a correspondence school and periodically submits lessons by mail to a teacher at the school for evaluation. The distinction between the two rests in the fact that schools using supervised correspondence study appoint a person to supervise the work of the student. This person administers tests, sees to the proper submission of lessons, and perhaps helps the student with some of the difficulties he may be having. The supervisor is generally a professional person (often a school teacher or administrator) in or near the community where the student lives. In regular correspondence study no such supervisory person from the student's

community is used. The study being reported was conducted with supervised correspondence study courses. The term "supervised" is not always used in the discussion to follow, but, unless otherwise indicated, the reader should consider the discussion and results to be based on information about supervised correspondence study courses.

Some procedures used in supervised correspondence study are defined now as the terms are used in the report.

Syllabus -- The course outline sent to the student. The assignments for each lesson and the material to be sent in for grading are included in the syllabus. The tests for the course are sent to the supervisor in a supervisor's manual. The supervisor administers each test when the student is ready. The term syllabus in this report will refer to all course materials sent to the student and supervisor except for the textbooks or commercial programs.

Unit -- A broad area of study within the course. A typical course will contain 7-10 units and most tests are over units.

Lesson -- The units are further divided into lessons. The lesson covers a specific topic in the course, and is the unit of work for the student. That is, the student completes the work for each lesson and submits work to the correspondence school by the lesson. The number of lessons in a course will usually be between 15 and 25.

Work Sheet -- Each lesson contains a work sheet which is the assigned work for that lesson to be completed and mailed to the correspondence teacher for evaluation.

Self-Check Tests -- These are brief objective type tests in each lesson. The key for the tests is provided in the syllabus. The tests

are used as a study aid for the student to check his learning of the material in a lesson.

Exercises and Study Aids -- Miscellaneous assignments or suggested activities in the syllabus that are provided to enhance the learning by the student. These activities usually are optional in that no check is made on whether the student has done them.

Supervisor -- The person in the student's community who supervises the work of the student. The supervisor mails the lessons, administers the tests, and checks on the student's progress. This person is not the teacher; however, he may provide help for the student at times.

Teacher -- The person at the correspondence school who evaluates the student's work and provides feedback to the student on the basis of the student's performance on the lessons and tests. The teacher in our school holds a state teaching certificate in the subject matter being taught.

Correspondence Study Research

The continually increasing use of correspondence courses is perhaps the best indication that the correspondence course is a successful medium of teaching. There is considerable research evidence that supports the judgment of the person who studies by correspondence. Data of various studies have indicated that students perform well on standardized achievement tests after taking a course by correspondence and that the performance of correspondence study students compares favorably with the performance of students in a typical classroom in a variety of subject matter areas (Childs, 1954; Bysinger and Bridgeman, 1957; Parson, 1957). Also college students who have studied a subject by correspondence while in high school,

perform as well at the college level in that subject area as students whose high school work was in the usual classroom situation (Childs, 1952).

The research on drop-outs from correspondence study courses has consistently yielded evidence that the majority of correspondence students complete the courses they begin (Garvey, 1949; Haberman, 1954; James and Wedemeyer, 1959). The failure of many students to complete seems to be because of circumstances unrelated to the correspondence course, e.g., moving to a community where the course is offered in a classroom setting.

Concerns of Correspondence Educators

An extensive annotated bibliography of writings about correspondence study, distributed in preliminary form in 1960 (Childs, et. al., 1960), contained many annotations of articles about three problems that seemed to be of much concern to educators in correspondence schools. Two of the problems are problems of education in general; that of determining techniques and procedures which will lead to increased learning on the part of the student and the drop-out problem. The third area of primary concern in correspondence study is with respect to the time taken to complete a course. This, of course, is not an important consideration in the regular school situation where the course length is set by the organization of the school year into quarters, trimesters, semesters, etc. Flexibility in time taken to complete a course is one of the selling points of correspondence study, but findings that completion time might be related to drop-out rate and to achievement (Ward, 1954; Haberman, 1954) have made the

correspondence educator concerned with techniques that will serve to pace the student through a course at a regular rate.

Programmed Instruction

As implied above, attempts are continually being made to improve the teaching and learning in correspondence study. A technique of instruction that has made a considerable impact on education in the last few years and seems to be applicable to correspondence study is programmed instruction. The professional and lay literature is replete with studies and articles demonstrating and/or espousing the virtues of programmed instruction. Some of the claims made for this method of instruction may have been exaggerated, especially when made on the basis of programs as they are now conceived. The findings in the majority of studies of programmed instruction have demonstrated that the study of programmed materials results in learning outcomes comparable to those attained in traditional learning situations such as the classroom or by reading (cf. Smith, 1962; Porter, 1959; Evans, et. al., 1959). Furthermore, some studies have demonstrated that not only is the learning as effective, but it is more efficient in programmed instruction when compared with other learning situations (cf. Hough, 1962; Porter, 1959; Ferster and Sapon, 1958). Efficiency, in this case, is defined as the time taken to complete the material. Programmed instruction has been shown to take significantly less time than other methods to attain a certain level of achievement.

It is recognized that there are varying ideas with respect to the definition of a program. The two most common kinds of programs are the intrinsic program exemplified by Crowder (1960) and the linear program attributed to Skinner (1954). We are not committed to one

method of programming over the other. In the study being reported, however, all of the programmed materials used were linear programs, and the reader should keep in mind that the term "program" in the rest of the report will be referring to the linear type of program.

Programmed instruction when first described seemed to be dependent in its effectiveness on the apparatus with which it was presented. Such apparatuses, usually called teaching machines, controlled the study situation and were especially useful in decreasing the possibility of "cheating" on the part of the student. Subsequent research has demonstrated rather conclusively that the teaching machine is not essential for learning to occur with programmed materials. Most researchers have reported no difference in learning between groups who study materials in a machine and groups who study the same materials in a programmed text format (Goldstein and Gotkin, 1962).

Many correspondence educators were aware of the possibilities of using programmed instruction in correspondence courses, but the problem of sending a machine by mail to a student loomed quite large. With the evidence that the machine was not an essential component of programmed instruction the application of this form of instruction to correspondence study will likely become more widespread.

The use of programmed instruction in correspondence courses seems to be almost made-to-order. When one considers the principles of programmed instruction and the principles of correspondence study certain similarities are evident between the two. The following discussion will compare and contrast the two methods in terms of five principles of programmed instruction.

Similarities between Correspondence Study and Programmed Instruction

Programmed instruction and correspondence study both allow for each learner to proceed at his own rate. Both methods use materials that are studied in individual situations so that external pacing is at a minimum. Some pacing or determination of the individual's rate of learning is established by the writer of the program or the correspondence study syllabus. One of the advantages, however, of both methods is that there is little or no pressure to keep up with other students or to complete the study of a unit within a certain number of periods.

Learner activity is required in both methods of instruction. A basic principle of programmed instruction is that the responses called for in the program frames increase the activity of the student in the study of the materials. The exercises and self-check tests in a correspondence study syllabus also require a high level of writing activity by the student in that the student must write a considerable amount for each lesson.

Programmed instruction and correspondence study are both highly structured methods of teaching. In developing the material for these methods, the writer of a program or of a syllabus has definite learning outcomes as objectives, and the procedure that the student is to follow is specified quite explicitly. There is little opportunity for digression by the person studying in either method. The writer of this report believes that this structuring now evident in most programs and correspondence syllabi negates to some extent the supposed advantage of the two methods that they individualize instruction. It seems that the individualization is only in terms of rate of proceeding through

the materials. There are attempts being made however, to develop programs and syllabi that provide for individual abilities, interests, and environments.

Knowledge of results is provided for in both methods. In the typical program the student receives this knowledge of whether his response is right or wrong immediately after making the response. Many correspondence study syllabi contain self-check tests which also provide the student with immediate knowledge of results. The self-check test is usually a 10 to 15 item objective type test with the answers provided elsewhere in the syllabus.

Points of Difference between the Two Methods

The knowledge of results feature is also a point of difference between programmed instruction and correspondence study in a couple of ways. In the first place the knowledge of results in programmed instruction is believed to be an essential part of the learning process. The student reads some material, is guided by the program to make a response, and then finds out immediately whether the response is right or wrong. Most programmers attempt to develop the materials so that the student will be very likely to make the correct response nearly every time. The desirability of the student's being correct is based on the belief that one learns to an extent any response given so the response should be the correct one. If the response is incorrect then unlearning of the incorrect response has to occur along with the learning of the correct response. Correct responses are also desirable because they are successful responses and evidence indicates that success facilitates learning (Skinner, 1954).

The self-check tests in the correspondence study syllabus do not use the knowledge of results feature in the same way as do programs. These tests, rather, serve as a check on how well the student has learned the material in the reading and other work assigned in the syllabus. This difference is not presented to argue that tests do not serve as a teaching device, but to indicate that although both methods do provide opportunities for the student to obtain immediate knowledge of results there is a real difference in the function of this feature between the two methods.

Another way in which the knowledge of results feature is a point of difference between programmed instruction and correspondence study is in terms of time. Whereas the knowledge of results in programmed instruction is referred to as being immediate, the majority of the written responses in correspondence courses are sent to the teacher at the correspondence school for evaluation. These written exercises are evaluated and returned to the student as quickly as possilbe, but this is necessarily a matter of days. The correspondence course is similar to the typical classroom procedure with respect to knowledge of results and Skinner (1954) suggests that this lack of immediate knowledge of results may seriously affect in an adverse way the effectiveness and efficiency of classroom teaching. This may be so especially with reference to knowledge of successful responses. According to Skinner, learning is most effective when the learner makes correct responses and these correct responses are reinforced by the learner's knowing immediately that the response is correct. The correspondence study lesson and the usual classroom assignment provide little opportunity for immediate knowledge of results and the reinforcing quality of the belated

knowledge is probably lost. Furthermore the procedure of many classroom or correspondence teachers is not to reinforce correct responses so much as to direct the learner's attention to incorrect responses.

Programmed instruction differs from correspondence study also in its attention to step size. The program proceeds in a series of small steps with the student attaining bit-by-bit the information taught in the program. The attention to small steps is required by the objective of having the learner make successful responses most of the time while working through the program. The correspondence study syllabus, on the other hand, is most often developed on the unit plan with several lessons in a unit. The lessons are the smallest breakdown of subject matter and a conscious effort to break the subject matter into smaller steps similar to those found in programs is seldom done by a syllabus writer.

Programmed instruction with its special advantages seemed to be a method that could be employed to improve the correspondence study method especially when studies demonstrated that a teaching machine was not an essential feature of programmed instruction. The highly structured step-by-step approach of programmed instruction along with the advantage of immediate knowledge of results could be incorportated into the correspondence study syllabus and thereby presumably increase the effectiveness and efficiency of learning with a correspondence course.

Chapter II

OBJECTIVES

The study reported in this paper was to attempt to determine whether materials constructed according to linear programming principles contributed significantly to more efficient and effective learning in a correspondence study setting. The data of the study allowed a test of three null hypotheses.

H_oI. -- There is no significant difference in means on an achievement test among students who study a course with programs as the primary study material, those who take a course containing supplementary programmed materials, and those who study with a presently used type of correspondence course that does not contain programmed materials.

H_oII. -- There is no significant difference in mean time taken to complete a correspondence course among students in the classifications mentioned in H_oI.

H_oIII. -- There is no significant difference in the proportion of drop-outs from the correspondence course among the same classifications.

Two high school correspondence courses, first semester algebra and first semester ninth grade English were used in the study and each of the null hypotheses was tested in connection with each of the courses.

The three courses in each of the subject matter areas differed in the following ways. The completely programmed course used a commercially programmed text, and the correspondence study syllabus accompanying it contained only brief exercises and tests to be mailed in periodically. The syllabus contained no explanations, only assigned the frames to be worked for each lesson. The brief work sheets and

tests were included so that the correspondence teacher could have more than the criterion test grade as a basis for evaluation. The programmed text used in the algebra course was the Encyclopedia Britannica TEMAC (1961) program in which frames one to 4600 were covered for the semester's work. The programmed text in English was English 2600 (1960) which was completely assigned.

The English course was divided so that the first half was on grammar and the second half a study of literature. The grammar portion of the course was different among the three courses, but the literature portion, which was not programmed, was the same in all three courses.

The presently used type of course was, as is implied, a course with a correspondence study syllabus and textbooks. The syllabus contained assignments in the textbooks, self-check tests, work sheets, and tests, and explanations or examples. The algebra course used in the project was the one in use by the correspondence school at that time since its content and the content of the TEMAC program were highly similar. The syllabus was written by Simpson (1957) and the textbook was by Grove, et. al. (1956). A new English syllabus was written by Prahl (1962) so that grammar content would parallel the material in English 2600. The grammar text used with the syllabus was Yates and DeLaney (1961). Prahl also developed the literature units for all of the English courses.

The reader can see that the courses mentioned would provide a means for comparing completely programmed material with correspondence courses. The third course developed for each subject matter was an attempt to develop a course in which the two methods were combined.

Programmed materials were developed to supplement each lesson in the correspondence course. A 30 to 50 frame program was written for each lesson. These programs were designed to teach the basic concept of the lesson, but other materials were included in the syllabus such as assignments in the text, explanations, work sheets, and other exercises. In order to keep work time roughly equated, the work sheets and exercises in the syllabus were somewhat shorter than in the regular correspondence study syllabus, but this syllabus was essentially a regular correspondence study syllabus with a brief program added to each lesson as another learning exercise for the student. Assignments were made in the same textbooks that were used in the regular correspondence courses. The programs were mimeographed pages in the syllabus and were assigned to be completed. No check was made, however, of whether the students actually worked these programs. If this type of format were to be used in correspondence courses there would be no check in that kind of situation. The correspondence teacher knows only that the student has done the assigned work that is mailed in.

Chapter III

PROCEDURE

The first phase of the project, starting in February, 1962, was the training of programmers and the selection of course materials. Three persons were selected as programmers. They were graduate students in Educational Psychology who had teaching majors or minors in the subject matter area to be programmed. The programmers all had teaching experience although for one this experience was limited to student teaching.

A three day workshop was held for the programmers and the project director for instruction in programming. A Research Associate from the American Institute for Research conducted the workshop. The consultant returned about six weeks after the workshop at which time he provided advise and constructive criticisms for each programmer on the programs that had been written during the six week period.

Two programmers wrote algebra programs and the other person wrote the English programs. The programmers would read, criticize, and serve as editors of one another's materials. The project director assumed final responsibility for editing the programs. The regular high school course editor in the school provided the editing service for all materials other than the programs.

Program Construction and Try-Out

The programs were written during the spring and summer of 1962. In final form there were 40 separate algebra programs in the 38 lessons. There was a total of 960 frames in the algebra programs or an average of 24 frames per program. The 23 English programs contained a total of 993 frames or an average of about 43 frames per program.

The first draft of the program was reviewed by the other programmers and the editor. A revision was then made and the first revision was worked through by students in a local junior high. Two ninth grade students who were in a general mathematics course rather than algebra were used for the algebra programs and two eighth grade students worked on the English programs. A second revision was then made of the program on the basis of this first try-out. The second revisions were tried out with a group of 14 junior high students for each subject. The students in these two groups worked through the programs in special sessions held during the month of June in a classroom at the University. The 28 students were all going to enter the ninth grade in the next semester.

The students worked through the programs and took brief mastery tests after working all of the programs that were to be in a unit of the correspondence course. Table 1 contains the error rate for each program and the mean mastery test score. The date in Table 1 should be considered with the understanding that the students worked through the programs with no other kind of learning activity in the subject matter areas. Thus, the programs at the end contained material that the student would normally encounter after nearly a semester of study. This was especially true of the algebra material, but even with respect to the English programs the students covered about as much material in 993 frames as they would have encountered in the 2600 frames of English 2600. These try-out students did none of the other activities that the correspondence study student would be assigned in the syllabus.

Table 1

Error rate and mastery test means of try-out groups on algebra and English programs

	Total No. of program	Total No. of frames	Prop of error to total responses	Mastery test mean
English				
Unit I The Sentence	3	86	.044	86.78%
Unit II Parts of Speech	8	297	.083	80.60%
Unit III Usage of Grammar	9	480	.091	79.65%
Unit IV Capitalization and Punctuation	3	130	.056	97.12%
Algebra				
Unit I Simple Equation	14	253	.082	85.32%
Unit II Solving Stated Problems	3	46	.112	83.11%
Unit III Signed Numbers	5	153	.075	80.03%
Unit IV Equation and Problems	4	98	.123	76.67%
Unit V Problems with 2 Unknowns	3	107	.103	76.12%
Unit VI Problems with 2 Unknowns	4	108	.124	75.34%
Unit VII Polynomials	7	194	.126	70.81%

The final revision of the program was then made on the basis of the responses of the students in the two groups of 14. These final revisions were the programs that were put into the syllabus for the method of study that used supplementary programmed materials.

The following list reviews the treatments and the materials used in each treatment.

Algebra -- 1. Programmed course -- The students studied assignments in the TEMAC programmed text and submitted brief work sheets and unit tests to the correspondence teacher.

2. Course with supplementary programs -- The syllabus contained work sheets, exercises, unit tests, and 30-50 frame programs in each lesson. Lesson assignments were also made in the regular textbook.

3. Regular correspondence course -- This course was the algebra course in use by the correspondence school at the time the study began. The syllabus contained work sheets, self-check tests, exercises, unit tests, explanatory material, and assignments in the regular textbook.

The coverage of algebra by these courses was essentially the same.

English -- The study involved the first four units of the ninth grade English course. The last four units on literature were the same in the three courses. The first four units differed as described below.

1. Programmed course -- The students work through the English 2600 programmed textbook. They submitted brief work sheets and the English 2600 unit tests to the correspondence teacher.

2. Course with supplementary programs -- The units covered the same material as that covered in English 2600. Each lesson in the syllabus had a program of about 50 frames along with work sheets, self-check tests, unit tests, and assignments in the regular textbook.

3. Regular correspondence course -- A new correspondence course syllabus was written for the project so that the grammar units would cover the same material as that covered in English 2600. The syllabus contained the usual work sheets, self-check tests, unit tests, explanations, and assignments in the regular textbook.

Pre-Tests -- Two tests were constructed to serve as pre-tests for the courses. A pre-test is commonly used in correspondence courses to provide information for the teacher. The pre-tests were also used in this study to determine the equivalence of the groups when starting the course. The pre-test items were selected by item analysis procedures from the final test administered to eighth grade arithmetic and eighth grade English students in a local junior high school. The algebra tests were administered to 248 students and the English tests to 85 students. The split-half reliability coefficient computed with Kuder-Richardson Formula 21 (Cronbach, 1960) for the algebra pre-test was .82 and it was .80 for the English pre-test. The pre-tests are included as Appendix A.

Criterion tests -- The selection of criterion measures was somewhat difficult especially for the English study. The Seattle Algebra Test (1951) (for end of first half year) seemed to sample well the learning

outcomes expected in the algebra courses. This test was used as the final algebra test and served as the criterion measure in the algebra study.

An English usage test, Test #3 of the Iowa Tests of Educational Development, (1958), was used as the criterion measure of the English study. No standardized achievement test in English seemed to sample all of the learning outcomes of the courses. The emphasis of the courses was on English usage so that the Test #3 of the ITED battery was considered an appropriate measure.

The determination of completion time and drop out as criteria will be discussed later in the report.

Sample Selection -- The three courses in each of the two subjects were ready for use by the first week in August, 1962. Thus the courses were available for the peak enrollment period in first semester algebra and first semester ninth grade English. Random distribution of the courses was attempted but not achieved. Although most of the correspondence courses are enrolled in by individuals who take the course alone, there are some instances when a group of students from one location will take a course in a sort of classroom setting. This kind of situation is quite common among the American students overseas. In many places there are a few American families but not enough to maintain a complete school. Two or three students at such places will often take the same course under the same supervisor. To avoid mix-ups and also to avoid knowledge on the part of the student that they were participating in an experiment, the same course was sent to students enrolling with the same address. This sampling procedure did not

allow random distribution, but it also lessened the likelihood of the "Hawthorne effect" operating.

The courses were distributed at random to the enrollees with the exception noted above in which case one of the courses was selected at random to send to all of the enrollees from a common location. A die was used for the random assignment of courses.

All students who enrolled in either of the two courses during the months of August through December of 1962 were included in the sample. The total sample for the algebra study was 186 with 65 taking the TEMAC course, 62 taking the course with supplementary programs, and 59 enrolled in the regular correspondence course. The English study had a sample size of 191 with 65 enrolled in the English 2600 course, 63 taking the supplementary program course, and 63 enrolled in the course with a regular syllabus.

The Henmon-Nelson Test of Mental Ability (1957) and the course pre-test were administered to the students by the supervisors. This was the first assignment of the course.

The Henmon-Nelson Test had been used in previous courses and many of the supervisors were familiar with its administration. The instructions for its administration are not involved and since most supervisors are experienced with testing procedures the scores should have been quite reliable. We are aware of the difficulties inherent in testing by mail and the fact that all tests may not have been administered under similar conditions is a recognized source of error in the study. Our rather wide experience in working with supervisors in the administration of correspondence courses, including the testing, should have tended to reduce this error.

One other comment with respect to testing and experimenting by mail is pertinent. The difficulties in communicating through the mails caused problems in that some supervisors and/or students did not always follow the directions in the syllabus. Consequently some students did not submit the Henmon-Nelson, others failed to send the pre-test, and for others the criterion test wasn't received. These students were followed up in an attempt to obtain complete data, but we failed to get the message to some. Any error because of these difficulties, however, could likely be assumed to be random error and would decrease the likelihood of a Type I error, which is the error of more concern to us.

The students followed regular correspondence study procedures in taking the courses. They were assigned materials to study and submitted work sheets and unit tests to the correspondence study teacher for evaluation. The teacher returned the submitted lessons with the usual comments and suggestions. One person taught all of the English courses, and two persons taught the algebra courses. The students in the algebra courses were divided among the two teachers with one teacher having all students whose last names began with the initials A through M, and the other teacher had the students with names beginning with N through Z. This procedure is often followed by the school in distributing the teacher load in certain subjects.

An enrollment in a correspondence course is for a year. After a year the student may renew his enrollment for another year, but if the course is not renewed the student is dropped. Most students who are going to complete do so within the year's time. The courses are written so that a student who spends as much time on the correspondence course as he would on a like course in the classroom will complete the

course in about 18 weeks. In the study being reported, the above procedure regarding completion was followed, except that any student who had not completed by December 31, 1963, was considered a non-completer even though the enrollment might have been renewed. Only three students in algebra and four in English were technically still active on December 31, 1963, and the teachers reported that none of these students were likely to complete the course.

The students in the groups of the study were compared on certain characteristics with a random sample of 80 students in ninth grade courses six months prior to the present study. The data from the comparisons are shown in Table 2. The data were obtained from questionnaires that the students filled out at the start of the course. This questionnaire is used in all courses to provide information about the students for use by the teacher. The data supported the assumption that the students enrolled in the algebra and English courses for the study being reported were representative of the students usually enrolled in these courses. It should be noted that not all of the students in the study being reported completed the questionnaire so that the data are only from those students who submitted questionnaires. The sex of all of the students in the project was available.

Table 2

Characteristics of Algebra and English Students as Compared with a Previous Random Sample of 80 Correspondence Students in Ninth Grade Courses

Age	14 and up	15 -18	19 and up
English	89	50	15
Algebra	65	34	9
Random	36	18	6

Sex	Male	Female
English	94	97
Algebra	104	82
Random	44	36

Address	Nebraska	U.S.	Overseas
English	15	78	98
Algebra	8	78	100
Random	10	35	45

Class Size	Not in school	10 or less	11-25	26 or more
English	100	69	16	6
Algebra	105	64	12	5
Random	46	24	7	3

Occupation of Father	Professional and Managerial	White Collar	Blue Collar	Service and Laborer	Not Reported
English	40	38	33	12	68
Algebra	26	26	23	5	106
Random	27	23	24	6	

Chapter IV

RESULTS

The results of the studies will be discussed separately with the algebra study presented first. The algebra groups are identified in the discussion as follows:

1. Temac group -- Group studying the course using the Temac programmed algebra course as their study material.
2. Typical group -- Group studying the regular correspondence course with a typical syllabus and text material.
3. Program group -- Group studying a course in which the syllabus contained supplementary 30-50 frame programs on each lesson. The student used the regular material and other exercises in the syllabus.

The Henmon-Nelson test and the course pre-test were administered to obtain information for the teachers about the students. The results of these tests were also used to determine the equivalence of the groups in mental ability and knowledge of the subject matter usually studied prior to algebra or ninth grade English. There was, of course, an assumption that the mental ability scores and the pre-test scores would be related to the scores on the criterion tests. The sampling procedure was such that differences among the groups' means on the Henmon-Nelson and on the pre-tests should have been no larger than one would expect to obtain by chance. Further, the correlation coefficients between each of the prior measures and the criterion measure within each group should not be expected to differ from the correlation coefficients of another group more than chance. If there were statistically significant differences among the means of the

groups on the prior measures we would need to control statistically for the variability accounted for by the prior measures with the analysis of covariance technique.

The means for the algebra groups on the Henmon-Nelson test and on the pre-tests are presented in Table 3. The N's differ because of the fact, mentioned earlier in the report, that we were not able to obtain complete test information from some of the students. The analyses of variance of the test means are presented in Table 4 and 5.

Table 3

Pre-test and Henmon-Nelson means of algebra groups

Group	Pre-test mean	N	Henmon-Nelson mean	N	Total N
Temac	16.09	47	108.53	49	65
Typical	16.95	44	113.11	44	59
Program	15.98	59	112.34	58	62
Total	16.30	150	111.33	151	186

Table 4

ANOVA of Algebra Pre-test Means

Source	Degrees of Freedom	Sum of Squares	Mean Square
Groups	2	583.69	291.85
Within	148	37779.75	255.27
Total	150	38363.44	

$F_{2,148} = 1.14$

Table 5

ANOVA of Henmon-Nelson means (algebra)

Source	Degrees of Freedom	Sum of Squares	Mean Square
Groups	2	26.95	13.48
Within	147	4084.55	27.79
Total	149	4111.50	

$F_{2,147} < 1$

There was no significant difference among the means of the algebra groups on either the pre-test or the Henmon-Nelson test. Some scores on each test were missing from each group, but it was probably safe to assume that the missing scores would not have changed the means of the groups significantly on either of the measures.

Algebra Completion -- Table 6 contains the data on the number of students who completed the courses in each group by the cut-off date. The cut-off date was December 31, 1963, which was 12-17 months after the enrollment date. The table also indicates the number of people on whom complete data were available.

A chi square of .366 was obtained when the total completers and total non-completers among the groups were compared. Such a chi square was, of course, not statistically significant. Therefore, the null hypothesis that there would be no significant difference in completion rate among the three algebra groups was not rejected. The three kinds of courses did not seem to have a different effect from one another on whether the student completed or did not complete.

Algebra Achievement -- The following discussion of data from the algebra groups is based on those students on whom complete data was

Table 6

Completers and Non-completers in Algebra Groups

Group	Completed (Complete data)	Completed (Incomplete data)	Completed (Total)	Non-completed (Test data available)	Non-completed (No test data)	Non-completed (Total)
Temac	27	1	28	22	15	37
Typical	27	0	27	18	14	32
Program	29	1	30	29	3	32
Total	83	2	85	69	32	101

available. There were two students who completed the course but did not send in the pre-test or the Henmon-Nelson. These two students were dropped from the groups for the analyses of criterion scores and completion times. One student with incomplete data was in the Temac group and the other in the program group.

The means and standard deviations for the completers on the Henmon-Nelson, the pre-test, the criterion test, and completion time are presented in Table 7. The criterion test (Seattle Algebra Test) scores were standard scores derived from tables in the manual and the completion time scores were in number of days from enrollment to completion.

Table 7

Means and standard deviation on Henmon-Nelson, pre-test, criterion test, completion time of algebra groups

Group	N	Henmon-Nelson		Pre-test		Criterion		Completion	
		$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
Temac	27	111.89	14.5	18.11	5.2	125.96	12.2	163.44	62.1
Typical	27	115.41	13.3	17.67	5.0	129.19	13.6	216.33	85.1
Program	29	116.62	19.2	18.00	4.1	128.41	11.4	239.66	76.4
Total	83	114.69	16.1	17.93	4.8	127.86	12.5	207.27	81.7

Table 8 presents the analysis of variance of the Henmon-Nelson scores for the algebra completers and Table 9 contains the analysis of the pre-test scores. The differences among the group means on the Henmon-Nelson and the pre-test were not statistically significant.

Pearson product moment coefficients of correlations were computed for each group between the Henmon-Nelson scores and the Seattle test scores, the Henmon-Nelson scores and completion time, pre-test scores

and Seattle test scores, and Seattle test scores and completion time. The coefficients are presented in Table 10.

Table 8

ANOVA of Henmon-Nelson scores for algebra completers

Source	Degrees of Freedom	Sum of Squares	Mean Squares
Groups	2	333.84	166.92
Within	80	21244.02	265.55
Total	82	21577.86	

$F_{2,80} < 1$

Table 9

ANOVA of algebra pre-test for algebra completers

Source	Degrees of Freedom	Sum of Squares	Mean Squares
Groups	2	2.90	1.45
Within	80	1882.67	23.53
Total	82	1885.57	

$F_{2,80} < 1$

Table 10

Pearson r's between variables for each algebra group

Group	Henmon-Nelson x Seattle	Pre-test x Seattle	Henmon-Nelson x Completion Time	Seattle x Completion Time
Temac	.221	.438*	.005	-.405*
Typical	.630**	.480*	-.096	-.071
Program	.548**	.464*	-.065	-.235

**Significantly different from a zero correlation at .01 level

*Significantly different from a zero correlation at .05 level

In all three groups the relationship between the pre-test scores and the criterion scores was significant at the .05 level and the relationship was of nearly the same magnitude. The three groups did not differ significantly in their pre-test means so it was not deemed necessary to control for pre-test scores when analyzing the criterion means.

The relationship between the Henmon-Nelson scores and the criterion scores was highly significant in the Typical and Program groups, but was not significant in the Temac group. The probability of obtaining coefficients of correlation with differences in magnitude as great as those obtained between the Temac group and the two other groups was determined using the Fisher Z transformation technique (Wert, et. al., 1954). The probability in both instances was less than .10 but greater than .05.

An analysis of variance was computed for the Seattle test scores. The lack of significant differences among the means of the groups on the Henmon-Nelson test and the pre-test indicated that it was unnecessary to control for these variables when analyzing the criterion test scores. An analysis of covariance was also deemed inappropriate because of the differences among the regression lines between the Henmon-Nelson test and the Seattle test within the groups. The use of analysis of covariance is based on the assumption that the regression line between the variables is equal within the groups. The regression line in this case between the Henmon-Nelson and the Seattle were quite different within the groups.

The analysis of variance of the Seattle test scores is presented in Table 11.

Table 11

ANOVA of Seattle test means

Score	DF	SS	MS
Among	2	153.48	76.74
Within	80	12,800.07	160.00
Total	82	12,953.55	

$$F_{2.80} = \frac{76.74}{160.00} < 1$$

The differences among the means of the groups on the Seattle Algebra Test were not statistically significant and the null hypothesis of no significant differences among the groups on the criterion means was not rejected. The Temac material, the Typical material, and the Programmed material appeared to be equally effective in attaining the learning objectives of the algebra course as measured by the Seattle Algebra Test.

Algebra Completion Time

The analysis of variance of completion time is presented in Table 12.

Table 12

ANOVA of completion time means among the algebra groups

Source	Degree of Freedom	Sum of Squares	Mean Square
Group	2	84,491.41	42,245.70
Within	80	469,499.22	5,868.74
Total	82	553,990.63	

$$F_{2,80} = 7.20$$

The difference among the completion time means was statistically significant at the .01 level. Computing "t" values among the pairs of means revealed that the Temac group completed the course in significantly less time than the other two groups. The difference between the Typical group and Program group means was not significant. The null hypothesis of no significant difference in completion time was rejected. The Temac materials apparently were more efficient than the Typical materials or the Programmed materials in that the students using the Temac course attained a similar level of achievement in significantly less time than the students in the other two courses.

The correlations among the variables, reported in Table 10, were consistent with findings of other studies regarding the relationships between achievement test scores and IQ test scores (c.f. Meyer, 1959; Porter, 1954; Detambel and Stolurow, 1956). The relationship between the IQ and achievement measures in the Temac group was not statistically significant whereas it was significant in the other two groups. The magnitude of the correlation in the Program group was smaller than in the Typical group. Although the differences between the correlations were not statistically significant, the data did suggest that achievement in algebra was less dependent on mental ability among students who studied programmed materials than among students who studied the typical correspondence course materials.

The correlations in the last column of Table 10 indicated a tendency for the person who completed early to score higher on the criterion test. This relationship was statistically significant in the Temac group and suggests to the writer that the effectiveness of programmed materials might be dependent on the student working on them at

regular and frequent intervals. This interpretation seemed especially tenable when the lack of a significant relationship between IQ and achievement measures was observed in the Temac group.

Algebra Completers vs Non-completers

The means of the completers and non-completers on the Henmon-Nelson test and the pre-test are presented in Table 13. The "t" value for each difference is also included. The fact that 33 Henmon-Nelson scores and 34 pre-test scores were not available from the non-completers whereas only 2 of these scores were missing from the completers should be considered. There was no way of knowing whether the persons who did not send in the tests differed from those who did. The data in Table 13 was interpreted on the assumption that the available scores were representative of the entire sample.

Table 13

Means of completers and non-completers on Henmon-Nelson and pre-test by group and total

Group	Completer	N	Non-Completer	N	"t"
			Henmon-Nelson Test		
Temac	111.89	27	104.41	22	1.99
Typical	115.41	27	109.47	17	1.95
Program	116.62	29	108.07	29	1.71
Total	114.69	83	107.23	68	2.91**
			Pre-test		
Temac	18.11	27	13.35	20	4.58**
Typical	17.67	27	15.89	17	1.05
Program	18.00	29	14.03	30	3.20**
Total	17.93	83	14.28	67	4.51**

**Significant difference between means at .01 level

The "t" values for the differences between both the Henmon-Nelson and the pre-test means were highly significant for the total groups in favor of the completers. The "t" values for each group on the Henmon-Nelson test were not significant, but the lack of significance was likely because of the small n's. The results did indicate that the students of higher mental ability were more likely to complete the course than students of lower mental ability. This result was not unexpected because it could be expected that some of the drops would be the less capable students. The drops from other kinds of educative activity tend to be less capable, and this would be expected in correspondence study as well. Childs, however, compared Henmon-Nelson scores of completers and non-completers in six courses and found no significant differences in four of the courses, one significant difference in favor of completers, and one in favor of non-completers (1963). His results with algebra students were not significant but the differences were in the same direction as that obtained in the study being reported.

The differences between the pre-test means were interesting. The differences were highly significant for the Temac, the Program, and the Total group with the completers having a higher pre-test mean than the non-completers. The difference was not significant in the Typical group. This result suggested that completion was more related to the math background of the student in the courses using programmed materials than in the course using typical materials. This point, however, should not be emphasized too much since the two analyses of variance among the group means within the completer-noncompleter classification yielded no significant F values. Thus there was no significant

difference among the group pre-test means for the completers and there was no significant difference among the group pre-test means for the non-completers.

Comparisons between Sexes

The hypotheses for the study did not specify that sex be used as a classification for the analyses. We were interested, however, in whether any relationships between sex and the criteria of completion time, achievement, and drop-out rate obtained. Table 14 contains the completion information for each of the algebra groups and for the total group with sex used as a classification.

No significant relationships were obtained between sex and completion. There was an indication of a tendency within the Temac group for the girls to be more likely to complete than the boys.

Two two-way analyses of variance were computed to determine any sex differences in completion time or in achievement on the Seattle Algebra Test. The cell frequencies were disproportionate for the two-way analyses so that the correction for disproportionality according to Patterson (1946) was applied to the data. Prior to the analyses of completion time means and Seattle test means similar two-way analyses were computed on the Henmon-Nelson means and the pre-test means. These latter analyses indicated no significant differences between the sexes.

Table 15 contains the Seattle test analysis of variance. The data in Table 15 were such as to indicate no significant difference between the sex means, no significant difference among the method means, and no significant interaction between sex and method on the Seattle Algebra test.

The analysis of completion time means is in Table 16.

Table 14

Completion rate in algebra courses by sex

	Complete	Non-Complete	Total
Temac			
Boys	13	25	38
Girls	15	12	27
Total	28	37	65

$X^2 = 2.91$ $.05 < p < .10$

Typical			
Boys	9	16	25
Girls	18	16	34
Total	27	32	59

$X^2 = 1.65$ $.10 < p < .20$

Program			
Boys	19	18	37
Girls	11	14	25
Total	30	32	62

$X^2 = .32$ $p < .50$

Total			
Boys	41	59	100
Girls	44	42	86
Total	85	101	186

$X^2 = 1.92$ $.10 < p < .20$

Table 15

ANOVA of Seattle Test means with sex as a classification (correction for disproportionality made)

Source	df	SS	Adjusted SS	MS	F
Sex	1	26.20	29.75	29.75	<1
Method	2	153.48	157.03	78.52	<1
Sex X Method	2	242.25	238.70	119.35	<1
Within	77	12531.62		162.75	
Total	82	12953.55			

Table 16

ANOVA of Completion means with sex as a classification (correction for disproportionality made)

Source	df	SS	Adjusted SS	MS	F
Sex	1	33,477.40	22,909.91	22,909.91	4.16*
Method	2	84,491.41	73,923.92	36,961.96	6.72**
Sex X Method	2	12,355.21	22,922.70	11,461.35	2.08
Within	77	423,666.61		5,502.16	
Total	82	553,990.63			

*p .01 < p < .05

**p < .01

The significant difference among the method means on completion time was obtained in the previous one-way analysis based on method only. A significant difference between the sex completion time means was also obtained. The mean completion time for boys was 228.1 days and for girls it was 187.9 days. The girls completed the algebra course in

significantly less time than the boys. The lack of a significant interaction indicated that the girls maintained this advantage over the boys in each method.

Summary of Algebra Study -- The following points summarize the results of the algebra study.

1. One of the three null hypotheses was rejected and the other two were not rejected. There was no significant difference among the groups on criterion test means or in their completion rates. There was a significant difference among the groups in mean completion time with the Temac group taking significantly less time to complete than the Typical or Program groups.
2. A lower correlation between achievement scores and mental ability test scores with students who used programs as compared with students studying other materials was obtained. This result was consistent with findings from other studies using programmed materials.
3. There was a significant negative relationship between criterion test performance and completion time among students using only programmed materials for study.
4. The students who completed the courses had significantly higher means on a mental ability test and on a pre-test than did the non-completers.
5. The sex of the student was not related to performance on the achievement test. There was a slight tendency for girls to be more likely to complete the course than boys especially in the Temac group. The girls completed the courses in significantly less time than the boys.

English Study Results -- The group labels "Typical" and "Program" are used in the English study report the same as in the algebra study. The group that studied completely programmed materials in English is called the "2600" group. The means of the English groups on the Henmon-Nelson and the pre-test are presented in Table 17. The N's are not the same in Table 17 because some students did not send in every test.

Table 17

Means of English groups on Henmon-Nelson and pre-test

Group	Henmon-Nelson	N	Pre-test	N	Total N
2600	106.28	53	45.59	54	65
Typical	113.47	49	48.20	51	63
Program	106.92	55	46.04	56	63
Total	108.75	157	46.57	161	191

The analyses of variance of the Henmon-Nelson means and of the pre-test means are presented in Tables 18 and 19.

Table 18

ANOVA of Henmon-Nelson scores for English study

Source	Degrees of Freedom	Sum of Squares	Mean Squares
Group	2	1596.55	798.28
Within	154	47202.76	306.51
Total	156	48799.31	

$F_{2,154} = 2.60$

Although the differences among the Henmon-Nelson means were quite large the F ratio from the analysis of variance was not statistically significant at the .05 level. The means of the pre-test scores did not

Table 19

ANOVA of English pre-test scores

Source	Degrees of Freedom	Sum of Squares	Mean Square
Group	2	202.42	101.21
Within	158	15831.01	100.20
Total	160	16033.43	

$F_{2,158} = 1.01$

differ enough for statistical significance. Thus, the three samples could be considered to be from the same population on the basis of their Henmon-Nelson and pre-test scores. The missing scores from each group, if available, would not be expected to change these results.

The English enrollments were taken during August through December, 1962. All students who had not completed or had dropped by December 31, 1963 were considered non-completers. The English study involved the first four units of an eight unit course. Consequently the definition of a completer for the purposes of the study was a person who completed the first four units of the English course within the 12-17 months allowed. The English teacher has told me that a majority who completed the first four units did complete the course. It would be expected that a student who completes half of a course would not be likely to drop.

English Completion

The data in Table 20 are the completion information for the first four units of the three English courses.

When comparing the completers by non-completers totals for the three groups a chi square of .258 was obtained which was not statistically significant. The null hypothesis of no significant difference in

Table 20

Completion information for first four units of English courses

Group	Completers (All Data)	(Inc. Data)	(Total)	Non-completers (Test Data)	(No Data)	(Total)
2600	41	5	46	10	9	19
Typical	36	7	43	9	11	20
Program	37	5	42	17	4	21
Total	114	17	131	36	24	60

the completion rate of the English courses using three different types of materials was not rejected. There was no apparent relationship between course materials and the completion rate for the first four units of the English course.

English Achievement

The analyses of the criterion test scores and of the completion times were done using only those students with complete data. The 17 students who completed the course, but did not send in all of the tests were dropped. To satisfy our curiosity analyses were computed for all students on whom criterion scores and completion time were available. The results of these analyses were no different from the analyses of the results of only those students for whom complete data were available.

Table 21 contains the means and standard deviations of the three groups on the Henmon-Nelson, the pre-test, ITED Test No. 3 (criterion), and the completion time.

The ITED scores were standard scores obtained from the manual, and the completion time was the number of days from enrollment to completion of the fourth unit.

Table 21

Means and standard deviations of English completers on four variables

Group	Henmon-Nelson			Pre-test		ITED		Completion time	
	N	$\bar{X}$	s	$\bar{X}$	s	$\bar{X}$	s	$\bar{X}$	s
2600	41	110.61	15.2	47.68	9.7	17.20	5.3	113.17	53.3
Typical	36	115.69	18.0	49.92	7.4	18.22	4.9	107.83	38.6
Program	37	112.76	17.6	48.62	9.4	16.35	4.8	134.05	65.8
Total	114	112.91		48.69		17.25		118.26	

The analysis of the Henmon-Nelson means is presented in Table 22 and of the pre-test means in Table 23.

Table 22

ANOVA of Henmon-Nelson scores of English completers

Source	Degrees of Freedom	Sum of Squares	Mean Square
Group	2	496.91	248.46
Within	111	32,714.21	294.72
Total	113	33,211.12	

$F_{2,111} < 1$

Table 23

ANOVA of pre-test scores of English completers

Source	Degrees of Freedom	Sum of Squares	Mean Square
Group	2	95.92	47.96
Within	111	9110.33	82.08
Total	113	9206.25	

$F_{2,111} < 1$

The F ratios for both analyses were less than 1.00 which indicated no significant difference among the three groups on either control variable, the Henmon-Nelson test or the pre-test.

Pearson product moment correlation coefficients were computed for each group between the Henmon-Nelson scores and criterion scores, the pre-test scores and the criterion scores, the Henmon-Nelson and completion time, and the criterion scores and completion time. The coefficients are presented in Table 24.

Table 24

Pearson r's between variables within English groups

Group	N	Henmon-Nelson X Criterion	Pre-test X Criterion	Henmon-Nelson X Completion Time	Completion Time X Criterion
2600	41	.725**	.784**	-.219	-.416**
Typical	36	.564**	.449**	.020	.170
Program	37	.680**	.771**	-.226	-.236

**Significantly different from zero correlation at .01 level

The correlations between the Henmon-Nelson scores and the criterion scores and between the pre-test scores and the criterion scores were all found to be significantly different from zero correlations at the .01 level. The Z-transformation technique was used to test whether the differences between the correlation coefficients were larger than could be expected to be obtained by chance. The differences between the Henmon-Nelson by criterion correlations were not statistically significant but the differences between the pre-test by criterion correlation in the Typical group and the correlation of the 2600 and Program groups were significant at the .01 level.

The observed equality of the groups on the Henmon-Nelson and on the pre-test indicated that the differences between the means of the groups could be examined with analysis of variance. The differences among the group's regression lines between the pre-test and the criterion also indicated that analysis of covariance would not be appropriate. Table 25 contains the analysis of variance of the means of the groups on the criterion measure. To satisfy my own curiosity, an analysis of covariance was computed with the Henmon-Nelson score controlled. The results were similar to those shown in Table 25.

Table 25

ANOVA of English criterion scores

Source	df	SS	MS
Among	2	64.03	32.02
Within	111	2895.09	26.08
Total	113	2959.12	

$F_{2,111} = 1.23$

The F ratio was not statistically significant. Therefore, the null hypothesis of no significant difference among the means of the groups on the criterion test was not rejected. Performance on test three of the Iowa Test of Educational Development was apparently not related to the methods used in the three English courses.

English Completion Time

The analysis of variance of completion time means among the three groups is present in Table 26.

Table 26

ANOVA of completion time among three English groups

Source	Degrees of Freedom	Sum of Squares	Mean Square
Groups	2	14,205.42	7102.71
Within	111	330,872.69	2980.84
Total	113	345,078.11	

$F_{2,111} = 2.38$

The F ratio was not statistically significant. Although the mean completion time for the Program group was considerably larger than for the other two groups, the difference was not statistically significant. The null hypothesis of no significant difference in mean completion time among ninth grade English students studying with three different types of materials was not rejected. There might have been a tendency for the students in the Program group to take more time than the students using other materials, but the relationship between course materials used and completion time was not statistically significant.

The correlations presented in Table 20 do not show the decreased relationship reported by other studies between mental ability and criterion performance among students who studied programmed materials. This somewhat different outcome might be because the English criterion test used in the present study might not have been specific enough to the material learned in the courses. Proper English usage is the goal of our English course, so we considered a test of English usage such as the one used appropriate because the concern was to compare the materials in terms of what were considered to be the objectives of our

courses. The point was recognized, however, that the lack of significant differences among the group means on the criterion test and the different relationship observed in this study as compared with other studies between mental ability and criterion performance with students using programmed materials might have been because of a lack of sensitivity in the criterion test to the differences among the groups or a lack of sensitivity in measuring the objectives of the course. This, of course, should be recognized as a possible factor in any comparison in which statistical significance is not obtained.

The significant negative correlation between completion time and the criterion measure in the 2600 group suggested that achievement among students studying programmed materials was related to their studying at regular and frequent intervals. The same finding was obtained in the algebra study of this report.

The means of the completers and non-completers from the Henmon-Nelson and the pre-test are in Table 27. Both scores were not available on these variables from 17 students who completed and from 24 students who did not complete. The discussion of the comparisons in Table 23 was based on the assumption that the students on whom data were not available were similar to the students on whom scores were available.

The completers as a total group had significantly higher means than the non-completers on both the Henmon-Nelson test and the English pre-test. Completers in the 2600 and the Program groups had significantly higher means than the non-completers, but this difference was not observed in the Typical group. This observed relationship between mental ability and completion rate among students studying programmed

Table 27

Means of completers and non-completers on Henmon-Nelson and English pre-test

Group	Completers	N	Non-Completers	N	"t"
			Henmon-Nelson		
2600	110.61	41	91.90	10	3.84**
Typical	115.69	36	107.00	8	1.55
Program	112.76	37	93.12	16	4.81**
Total	112.91	114	96.03	34	5.99**
			Pre-test		
2600	47.68	41	41.22	9	1.67
Typical	49.92	36	43.11	9	1.88
Program	48.62	37	39.47	15	3.47**
Total	48.69	114	40.94	33	4.25**

**Significant at .01 level

materials is supported by an ANOVA of the non-completer Henmon-Nelson scores which indicated the mean of the non-completers in the Typical group was significantly higher than the means of the non-completers in the other two groups. Completion in the Program group was significantly related to pre-test scores, but this relationship was not evident in the other groups.

Comparison of Performance of Sexes in English

Table 28 presents the completion data in each of the English courses and for the total group when the students are classified by sex.

Table 28

Completion in English courses by sex

	Complete	Non-Complete	Total
	2600		
Boys	23	13	36
Girls	23	6	29
Total	46	19	65
$X^2 = 1.89$	$.10 < p < .20$		
	Typical		
Boys	19	10	29
Girls	24	10	34
Total	43	20	63
$X^2 = .18$	$p < .50$		
	Program		
Boys	17	12	29
Girls	25	9	34
Total	42	21	63
$X^2 = 1.50$	$.20 < p < .30$		
	Total		
Boys	59	35	94
Girls	72	25	97
Total	131	60	191
$X^2 = 2.91$	$.05 < p < .10$		

No strong relationship was evident between completion and sex but for the total group a tendency was indicated that the girls were more likely to complete the course than the boys.

Two-way analyses of variance were computed on the English achievement test and on completion time in English. In order to attain proportional frequencies in the cells one boy was dropped at random from the 2600 group and one girl was dropped at random from the Program group. This procedure left 18 boys and 22 girls in the 2600 group and 16 boys and 20 girls in each of the other groups. Analyses of variance of the Henmon-Nelson and the pre-test means revealed no significant difference between the sexes on these measures.

In Tables 29 and 30 the sum of squares column differs from those in Tables 25 and 26 because of the two scores dropped from the two-way analyses.

Table 29

ANOVA of English achievement test with sex as a classification

Source	of	SS	MS	F
Sex	1	219.00	219.00	9.00**
Method	2	58.96	29.48	1.21
Sex X Method	2	5.95	2.97	<1
Within	106	2,577.80	24.32	
Total	111	2,861.71		

**Significant at .01 level

The two-way analysis of achievement test means presented in Table 29 revealed no significant difference among the methods, but a highly significant difference between the sexes which was consistently in favor of the girls in all methods. The girls mean of 18.6 was significantly higher than the boys mean of 15.7 and the insignificant interaction mean indicated this advantage prevailed in all methods.

Table 30

ANOVA of English completion time with sex as a classification

Source	of	SS	MS	F
Sex	1	5,330.91	5330.91	1.77
Method	2	13,916.48	6958.24	2.31
Sex X Method	2	2,011.90	1005.95	<1
Within	106	319,286.27	3012.13	
Total	111	340,545.56		

The data in Table 30 indicated no significant difference between the sexes, no significant difference among the methods, and no significant interaction between sex and method in completion time means in the English courses.

Summary of English Study

1. The three null hypotheses of the study were not rejected. There were no significant differences in completion rate, in criterion test means, and in completion time means among students who studied the first four units of a ninth grade English course using completely programmed materials, a typical correspondence course, or a course with supplementary 30-50 frame programs in each lesson.
2. The finding of other studies that achievement after studying programmed materials had little or no relationship with mental ability was not obtained in this study of English students with whom criterion test performance was significantly related to mental ability.

3. There was a significant negative relationship between completion time and criterion test performance among students using only programmed materials.
4. The mental ability test means and the English pre-test means were significantly higher for the completers than for the non-completers.
5. When the subjects were classified by sex, there was a tendency noted in the data for girls to be more likely to complete the English course than boys. Also a significant difference was obtained between the achievement test means of the sexes in favor of the girls. No apparent relationship was observed between sex and completion time.

Comparison of English and Algebra Studies -- It should be pointed out that the comparisons made in this project were only with respect to the specific materials used in the English study or the algebra study. The purpose of the research was to attempt to determine whether programmed materials as complete study materials or as supplementary study materials could contribute to the effectiveness and efficiency of learning when studying a correspondence course and whether there was a differential effect between the two kinds of materials. Students in the Typical course served as a control group. In a study such as this, the comparisons can only be made between the specific materials used and statements or generalizations about the methods are possible only if the assumption is made that the study materials used in each method are representative of the general class of materials included in the method. Thus, the significantly less mean time taken to complete the Temac course when compared with the Typical or Program

course does indicate that a student can be expected to complete this Temac course more quickly than if he took this Typical course or this Program course. But the generalization that students can complete a course that is entirely programmed more quickly than they can complete a course using supplementary programs or a typical correspondence course can only be made when these specific courses are assumed to be representative of the general class of such courses. Most comparisons of educational methods or materials are subject to this limitation. The investigator believes such comparisons are necessary and that generalizations are made possible when replications of the experiment are conducted holding methods constant over replications and varying the materials or holding materials constant over replications and varying the methods.

Similarities

The results of the two studies reported, in which methods were the same but materials differed, were similar in some respects and also different. The completion rate was not significantly related to the method used in both the English study and the algebra study. In both studies performances on the criterion measure were not significantly related to the method used.

Another similar finding in the two studies was that there was a significant negative correlation between criterion test performance and completion time among students in both English and algebra who studied only programmed materials. The students who completed the completely programmed course rather quickly tended to score higher on the criterion test than those who completed at a slower rate.

This finding was interpreted as being suggestive that success in learning with programmed materials in a correspondence course might be

somewhat dependent on the student's studying the materials regularly and frequently. The results could also indicate a tendency for the brighter student to work more rapidly than the slower student when he is studying programmed materials by correspondence but that the rate of work is not related to ability level when studying the other kinds of courses. The first explanation seemed more tenable in view of the correlations obtained between ability level and criterion performance with the algebra students.

Among the algebra students the relationship between IQ and criterion scores was not significant for students studying only programmed materials. Consequently, the negative relationship between criterion scores and completion time seemed to be independent of the mental ability of the student. It should be recognized, however, that the relationship between IQ scores and criterion scores was statistically significant for students studying completely programmed materials in English. Thus the negative relationship between criterion scores and completion time in English might not be independent of mental ability.

The students who completed the courses in both subjects had significantly higher mental ability test means and pre-test means than did non-completers. Completion of the courses seemed to be related to the ability of the students and to their background or prior knowledge of the subject. There was a tendency noted in both studies that the girls were more likely to complete the courses than were the boys.

Two sex differences were observed in the studies. The girls completed all of the algebra and English courses in less time than the boys. The difference between the completion time means was statistically

significant in the algebra study, and in the same direction but not statistically significant in the English study. The other sex difference was also in favor of the girls. They had significantly higher means on the English criterion test than did the boys. The girls also obtained higher means than the boys on the algebra criterion test but the difference was not statistically significant.

The above findings were similar in both studies, and, as such, suggested a likelihood that similar results would obtain if the methods should be compared using course materials different from those used in these studies.

Differences

The results from the studies differed on two points. In the algebra study there was a significant difference in mean completion time among the three groups with the Temac group taking less time. There was no significant difference in mean completion time among the three English groups.

The second difference was with respect to the correlation between the mental ability test and the criterion test. These correlations in the three English groups were rather high and were significant. Likewise the correlations were rather high and significant in two of the three algebra groups but in the Temac group the correlation was not significant. Only in the algebra group using completely programmed materials was the relationship between mental ability and criterion performance so low to be considered not significant.

These different results, both with respect to students using completely programmed materials, enable one to predict little about the

effects of the methods on completion time or on students of differing levels of mental ability. Previous studies comparing the programmed method with other methods have yielded results to indicate that the study of programmed materials resulted in achievement equal to that from studying by other methods but in significantly less time. Previous studies have also found that the correlation was lower between mental ability and achievement scores among students studying programmed materials than among students using other than programmed materials. Thus, the results obtained in the algebra study were more consistent with other studies in these respects than were the results of the English study. There was no apparent reason for the results in the English study with respect to completion time and the mental ability-criterion correlation being different from the algebra study results and results of other studies. The investigator believes the findings of the algebra study would be likely to obtain in replications comparing programmed instruction with other methods because the algebra result was more consistent with other studies than the English result.

Chapter V

CONCLUSIONS

The experience from conducting this research and the results of the research have helped us make some decisions with respect to using programmed instructional materials in correspondence courses. The following points were supported in varying respects by the research.

1. A correspondence study student will attain certain of the objectives of a course equally well by studying programmed materials (either as the primary study material or as supplementary material) or the conventional correspondence study materials. Our research yielded no evidence with respect to the learning in the affective domain, but the above conclusion seemed justified with respect to the cognitive domain.
2. The use of programmed materials as the primary study materials contributed to efficiency for the student, for the school, or both. In the algebra study the efficiency was enhanced for both the student and the school. The algebra students who used completely programmed materials scored as well on the criterion test, but completed the course in significantly less time than students studying the regular course, or students studying a course with supplementary programs. The efficiency for the school resulted from the fact that the material submitted to the correspondence school was much shorter and submitted less often in the course using the programmed materials than in the other two courses. Thus, the teacher's time per student was less in the course using

completely programmed materials than the other courses, along with less time and cost for the administrative and clerical staff because of the reduced number of mailings and recordings of information.

The completion times for the English courses were not significantly different, but the increase in efficiency for the school was true. The English course that used the complete programmed materials had fewer and shorter mailings than the other two courses so the teacher and administrative time savings mentioned for the algebra course were also evident in the English course.

3. Successful attainment of learning objectives seems to be less related to mental ability when students study completely programmed materials as compared with other materials. This apparent lack of high relationship between mental ability and criterion performance was evidenced in the algebra study of this project, but not in the English study. The results of the algebra study in this respect are consistent with those obtained in other studies.

4. Programmed materials are used most effectively when they are studied regularly and frequently. In both the algebra study and the English study, in the groups using completely programmed materials, the students who completed the course earliest tended to score higher on the criterion test. This relationship did not hold in the other groups. The low correlations between mental ability and criterion performance in the group studying only programmed algebra materials and

between mental ability and completion time in both English and algebra suggested that the negative correlation between criterion test performance and completion time was not because of differences in ability, but was indicative of how programmed materials could be studied most effectively.

5. Completion of correspondence courses is related to mental ability regardless of the methods used. The capable student is more likely to complete a correspondence course than the student with low ability. Studies might well be made of methods and materials that would be helpful in teaching the low ability student by correspondence. Such studies might be especially useful in view of the fact that the high school drop-out, who often is from the lower-ability levels, is likely to be enrolling in correspondence courses in increasing numbers.
6. Success in correspondence instruction seems to be somewhat related to sex. Girls tend to be more likely to complete, to complete in a shorter period of time, and to score higher on criterion achievement tests than do boys. Whether this advantage for the girls is related to the correspondence method of study or whether it reflects a general scholastic superiority of girls over boys is not evident from the results of this study.
7. The brief programs accompanying each lesson in the course using supplementary programs did not appear to add to the learning attained. We do not know whether this was because the programs were not effective in teaching, because the criterion instrument did not measure the differences, or because the students did not

use the programs. The supplementary programs were assigned but not all of the students may have studied them since they were given assignments in the regular textbook. We believe that the results of the study suggest that for programs to be effective they should be used as the primary study material in a lesson (at least for those things taught by the program) and that supplementary programs such as those used in this study do not contribute enough to the learning outcomes desired to justify the expense of constructing them.

8. The resources available in a correspondence school such as ours in terms of staff and money are not such that we should devote much energy to developing programmed materials. We found in conducting this study that developing programmed materials is a very expensive process. We do intend to use programmed materials in our courses. This study and other researches have demonstrated that programs can be used to advantage. We do believe, however, that the commerical publishing houses have the staff and the resources to develop quality programs more economically than we can. Programs will be selected for and used in the correspondence courses on the same basis as textbooks are now selected and used. It is likely that some programs will be developed by us for certain specific purposes, but the majority of the programs used in our courses will be purchased from the publishing concerns.

Summary

A comparison of programmed instruction and supervised correspondence study suggested not only certain points of similarity between the two methods of instruction, but also that programmed instructional materials might be used in correspondence courses to accelerate and enhance the learning by correspondence study students.

The project was designed to examine two related questions. The first question was whether programmed materials could be used effectively in correspondence courses to accelerate progress, to enhance learning, and to reduce the drop-out rate. The second question was related to how programmed materials could be most effectively used--as the primary study materials for a course or as supplementary materials along with other activities commonly used in correspondence study.

Experimental materials were developed for two subject matter areas--English and algebra. The materials were developed for the first semester 9th-grade course in these subjects. In both subjects, three sets of material were developed. The sets differed in both subjects in the following ways:

Set number one - The primary study material was a commerical program. A brief syllabus accompanied the program. The syllabus contained directions for study and brief assignments but no explanatory material.

Set number two - The syllabus for the course contained the material usually found in a correspondence course--work sheets, study directions, exercises, and self-check tests. These activities were shortened somewhat from what was usually found and 30-50 frame programs were included in each lesson. These programs, which were

developed as part of the project, were designed to teach the basic concept or point of the lesson but were intended to be only supplementary to the other activities in the syllabus and textbook.

Set number three - This set of materials was a correspondence course in the format typically used by the school.

The correspondence courses were distributed to enrollees in the subjects from August to December, 1962. A total of 191 students enrolled in first semester 9th-grade English and 186 enrolled in algebra.

The main comparisons of the study were on the variables of achievement, completion time and drop-out rate. No significant differences were found in English or algebra among the achievement test means or the drop-out rate of the groups studying by the three methods. The algebra students who studied the set using programmed materials as the primary study material completed the course in significantly less mean time (nearly two months) than the students using materials with supplementary programs or the regular correspondence course. In the English course no significant difference was found among the groups in mean completion time. The courses with programmed materials as the primary material required less administrative and teaching time than the other courses. It would appear that programmed materials can serve to increase efficiency of instruction by correspondence either in terms of learner time, teacher time, or both, without having an adverse effect on the achievement of the student. This finding appears to be most likely when the programmed materials are used as the primary study materials. The use of supplementary programs in the syllabus does not appear to increase efficiency or affect learning. A negative

correlation obtained between completion time and achievement test scores for students using complete programmed materials in both English and algebra suggested that programs are most effective when they are studied at regular and frequent intervals.

Some suggestions regarding the use of programmed instruction in correspondence courses were made in the conclusions.

APPENDIX A

Algebra Pre-test

Part I

Put the letter of the best answer on the blank to the left.

___ 1. The ratio of 10 : $2\frac{1}{2}$ is:

a. 5 b. 4 c. 25 d. $\frac{1}{4}$

___ 2. A baseball team won 24 games and lost 16 games. What was the ratio of number of games won to the total number of games played?

a. $\frac{3}{5}$ b. 4 c. $\frac{5}{3}$ d. $\frac{2}{3}$

___ 3. A vertical rod 4 ft. high had a shadow 6 ft. long. Approximately how tall is a flagpole whose shadow is 100 ft. long at the same time?

a. 83 ft. b. 150 ft. c. 61 ft. d. 67 ft.

___ 4. A statement showing that two ratios are equal is called (a) an equation, (b) a proportion, (c) a measurement, (d) a fraction.

___ 5. Money paid for the use of money is called (a) loans, (b) notes, (c) interest, (d) bonds.

___ 6. The interest on $1,080 at 6% for 72 days is

a. $13.24 b. $12.96 c. $64.80 d. $10.80

___ 7. The sum paid to an insurance company for insurance is called the (a) beneficiary, (b) premium, (c) face value, (d) interest.

___ 8. A house had an assessed value of $5850. The city tax rate was $24.60 per $1000 and the county tax rate was $10.50 per $1000. Approximately what was the tax bill for the house.

a. $2100 b. $144 c. $2000 d. $205

___ 9. The furnishings in a home are to be insured for $4700. Approximately what is the premium on a 3-year policy if the yearly rate is $.35 per $100? (Assume a constant rate for the three years.)

a. $16 b. $50 c. $490 d. $5

___10. On a certain day the cost, in cents, of three articles bought by a girl was c, c + 5, and 2c + 1. What was the combined cost of the articles?

a. 10c b. 4c + 6 c. 3c + 2 d. 92 cents

Select the right equation in each of the following.

___11. After 28 in. were cut from a board, the remaining piece was 36 in. long. What was the original length of the board?

a. $\ell + 28 = 36$

b. $\ell - 28 = 36$

c. $36 - \ell = 28$

d. $\frac{7}{9}\ell = 36$

___12. What is the average cost per card if 25 cards cost $1.00?

a. $c + 25 = 100$

b. $\frac{1}{25}c = 100$

c. $25c = 100$

d. $25 - c = 100$

___13. On a two-day trip of 375 miles, a man drove 45 mi. further on the second day than on the first. How far did he travel each day?

a. $2d + 45 = 375$

b. $2d \cdot (45) = 375$

c. $375 + 2d = 45$

d. $\frac{2d}{45} = 375$

___14. The value of a number regardless of its sign is called its

a. real value

b. estimated value

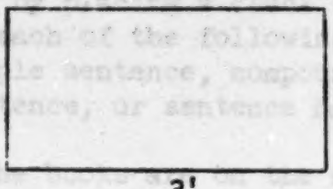
c. positive value

d. absolute value

Part II

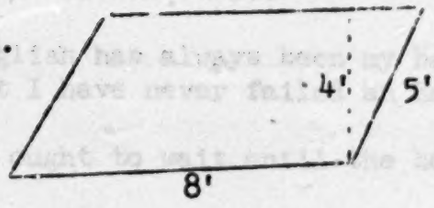
Match the formula with the figures. Put the letter of the correct answer on the blank to the left.

____ 1.

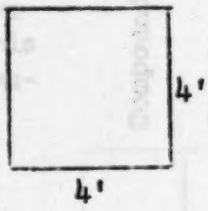


____ 2.

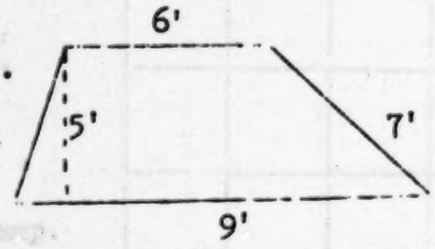
____ 3.



____ 4.



____ 5.



____ 6.

a. $a = \pi r^2$ c. $a = s^2$ e. $a = lw$ g. $a = lwh$

b. $a = bh$ d. $a = 2\pi r$ d. $a = \frac{1}{2}bh$ h. $a = \frac{1}{2}h\ (b + b')$

____ 7. Figure 1
- a. 5 sq. ft.
- b. 6 sq. ft.
- c. 10 sq. ft.
- d. $\frac{2}{3}$ sq. ft.

____ 8. Figure 2
- a. 22.2 sq. ft.
- b. 24 sq. ft.
- c. 44.4 sq. ft.
- d. 48 sq. ft.

____ 9. Figure 3
- a. 40 sq. ft.
- b. 32 sq. ft.
- c. 24 sq. ft.
- d. 26 sq. ft.

____ 10. Figure 4
- a. 8 sq. ft.
- b. 4 sq. ft.
- c. 16 sq. ft.
- d. 12 sq. ft.

____ 11. Figure 5
- a. 54 sq. ft.
- b. 58.5 sq. ft.
- c. 52.5 sq. ft.
- d. 37.5 sq. ft.

____ 12. Figure 6
- a. 18.8 sq. ft.
- b. 9.4 sq. ft.
- c. 28.3 sq. ft.
- d. 56.6 sq. ft.

English Pre-test

Part I

Indicate by placing a check in the right box whether each of the following groups of words is a simple sentence, compound sentence, complex sentence, or sentence fragment.

	Compound	Simple	Complex	Fragment
1. If the books are on the new-book shelf, they may be borrowed for a week.				
2. Her two dogs, a collie and a spaniel, perform different duties on the farm.				
3. The pilot, who was a veteran flier, brought his plane down safely.				
4. Please run to the store and buy a stamp.				
5. The latest books on the counter at the front of the store.				
6. English has always been my hardest subject, but I have never failed an English test.				
7. We ought to wait until the boys get home.				

Part II

Insert periods, question marks, exclamation points, commas, quotation marks, colons, semicolns, and apostrophes where they are needed.

1. Do you think Lewis said Al that I can carry two blankets some cooking utensils and a lumber jacket in my pack

2. We were told to copy these abbreviations bbl pk acct vol

3. Arent his gs queerly made

Part III

Indicate with a check in the right box the part of speech of the underlined words in the following sentences.

	noun	pronoun	verb	adjective	adverb	preposition	interjection	conjunction
1. Have you read today's <u>paper</u>?								
2. The hail did much <u>damage</u> to the crops.								
3. Miss Brooks is <u>teaching</u> the class.								
4. I will <u>paper</u> the living room.								
5. The ball was <u>under</u> the house.								
6. <u>Ouch</u>! that smarts.								
7. The <u>paper</u> napkin that clings like cloth.								
8. I have <u>never</u> seen a better ball game.								
9. <u>Turn</u> off the water.								
10. <u>Aha</u>! now you're beat.								
11. I shall be there in a little <u>while</u>.								
12. We moved <u>out</u> yesterday.								
13. She is <u>in</u> the house.								
14. The <u>after</u> cabin of the ship is full of water.								
15. <u>It</u> is your turn to play.								
16. John Glenn is <u>courageous</u>.								
17. <u>Someone</u> has eaten my cake.								

Part IV

Read the following sentence. For those words that have a number over them indicate with a check in the yes or no column whether the word should be capitalized.

A B

Example: The capital of Nebraska is lincoln.

	yes	no
A		✓
B	✓	

1 2 3 4 5 6

In carl becker's book "the era before the

7 8

revolution," the author shows the part

9 10 11

played by leaders like samuel adams and

12 13 14

patrick henry before the revolutionary

15

war.

	yes	no
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

Part V

Underline the correct word in the parentheses.

1. Mother and (he, him) will be home later.
2. (We, Us) juniors won the track meet.
3. It might have been (her, she).

4. It is (me, I).

5. He has been playing golf (regular, regularly).

6. She sang (good, well).

7. I chose this book because it was the (shortest, shorter) of the three.

8. Between John and Mary, John is (happier, happiest).

9. (Lie, Lay) down and go to sleep.

10. I could (have, of) finished in another hour.

11. (Who's, Whose) instrument is not in (its, it's) case?

12. (Their, They're) afraid that (your, you're) not serious about going.

13. This model (don't, doesn't) cost any more.

14. One of my cousins (play, plays) on the basketball team.

15. The garage straightened out the dent in the fender very (satisfactory, satisfactorily).

Part VI

Indicate with a check in the right box whether the underlined nouns are abstract, concrete, collective, or proper.

	Abst.	Conc.	Coll.	Proper
1. <u>English Ix</u> is a ninth grade course.				
2. The tornado did much <u>damage</u> to the houses.				
3. A <u>flock</u> of geese was flying overhead.				
4. <u>Love</u> makes the world go 'round.				
5. Most people take <u>pride</u> in their work.				
6. Last semester the <u>class</u> learned about nouns.				
7. The <u>aroma</u> of a pizza was coming from the restaurant.				
8. Value often comes in small <u>packages</u>.				
9. A World Fair is being held in <u>Seattle</u>.				
10. The <u>problem</u> was very difficult to solve.				

APPENDIX B

Algebra study data (Completers)

Typical

Student	HN	Pre	Criterion	Completion Time
1	94	12	97	184
2	106	10	117	358
3	145	24	153	252
4	122	12	127	121
5	128	17	134	339
6	121	16	144	218
7	99	19	127	264
8	115	17	116	366
9	111	12	124	355
*10	111	23	121	158
11	112	15	119	186
12	125	19	119	127
13	101	9	136	194
14	113	15	130	390
15	104	11	132	161
16	118	19	119	193
17	131	24	156	224
18	142	25	144	120
19	117	23	136	350
20	117	22	144	114
21	95	12	114	181
22	135	24	132	145
23	103	21	144	168
24	129	24	141	121
25	111	21	127	195
26	112	12	130	187
27	99	19	105	170

*Start of girls' scores

Program

Student	HN	Pre	Criterion	Completion Time
1	114	22	124	324
2	114	24	134	248
3	144	21	144	138
4	116	21	141	189
5	89	21	144	246
6	166	24	150	404
7	100	18	113	366
8	104	17	141	170
9	133	19	130	153
10	108	15	134	218

Student	HN	Pre	Criterion	Completion Time
11	99	13	121	249
12	114	23	118	268
13	97	14	124	360
14	130	18	141	177
15	101	14	126	293
16	86	17	110	200
17	134	24	134	233
18	124	15	124	240
19	93	10	114	202
*20	109	20	124	220
21	128	19	121	177
22	117	18	132	220
23	115	14	113	180
24	149	18	150	70
25	99	16	127	220
26	114	23	126	215
27	148	10	126	264
28	134	22	130	398
29	103	12	108	308
30	114	12		139

*Start of girls' scores

TEMAC

Student	HN	Pre	Criterion	Completion Time
1	91	16	116	179
2	121	22	124	219
3	103	15	126	198
4	107	23	132	49
5	120	22	144	118
6	101	18	139	141
7	96	9	127	147
8	101	21	150	64
9	112	22	144	195
10	106	12	97	172
11	111	20	117	181
12	109	8	116	326
13			149	171
*14	116	25	132	122
15	142	19	127	136
16	119	23	113	162
17	131	20	136	108
18	111	19	116	213
19	102	18	117	189
20	121	9	127	159
21	83	23	122	128
22	114	24	127	164

Student	HN	Pre	Criterion.	Completion Time
23	106	18	127	235
24	110	12	124	214
25	90	11	104	152
26	145	23	122	268
27	121	25	147	140
28	132	12	128	34

*Start of girls' scores

English Study Data (Completers)

Student	HN	Typical Pre	Criterion	Completion Time
1	86	50	8	109
2	123	44	17	89
3	139	32	21	89
4	100	39	11	126
5	120	52	16	65
6	145	63	25	140
7	121	56	25	129
8	113	48	19	166
9	100	59	21	162
10	108	59	13	77
11	113	52	12	85
12	99	53	14	142
13	111	51	23	120
14	117	43	17	119
15	115	43	18	185
16	109	36	12	155
17	105	40		61
18	92	46		181
19	122	48		101
*20	111	48	13	88
21	101	53	14	137
22	98	42	11	31
23	119	49	23	116
24	111	44	15	116
25	118	55	19	89
26	112	49	19	83
27	166	60	21	101
28	142	52	22	68
29	117	54	17	96
30	103	47	20	81
31	117	57	23	54
32	95	47	16	41
33	78	57	24	125
34	129	54	24	46
35	142	53	29	157
36	96	33	11	103
37	130	56	22	193
38	112	58	18	99
39	149	49	23	100
40		45	10	225
41	111	48		115
42	109	46		117

*Start of girls' scores

Program

Student	HN	Pre	Criterion	Completion Time
1	96	32	8	135
2	85	31	3	106
3	166	59	20	173
4	100	50	14	216
5	115	45	18	100
6	96	37	12	191
7	108	52	13	148
8	122	64	20	64
9	114	53	13	107
10	99	47	10	75
11	118	47	19	234
12	97	45	10	140
13	101	41	16	198
14	112	43	18	86
15	103	53	18	119
16	134	63	21	123
17		39	14	94
*18	95	43	12	255
19	112	45	16	136
20	89	44	10	93
21	112	56	17	64
22	125	60	23	55
23	113	56	17	139
24	131	56	20	69
25	113	46	20	149
26	97	33	13	242
27	114	38	15	87
28	126	41	11	64
29	99	61	20	53
30	118	51	18	164
31	145	61	25	77
32	107	60	23	101
33	112	56	21	67
34	116	56	20	130
35	94	27	13	364
36	134	52	23	124
37	155	52	21	157
**38	99	43	14	155
39	91			51
40	128	55		101
41		44	14	126
42		49	13	132

*Start of girls' scores
**Person dropped from two-way analysis

2600 Group

Student	HN	Pre	Criterion	Completion Time
1	114	50	16	193
2	91	39	13	122
3	121	55	21	134
4	116	57	17	48
**5	85	24	8	174
6	102	43	14	113
7	101	49	11	130
8	118	57	20	48
9	112	35	13	176
10	101	45	15	197
11	83	31	7	89
12	128	57	22	112
13	110	51	16	81
14	105	51	19	79
15	121	49	22	74
16	106	46	17	72
17	104	36	17	149
18	104	32	7	177
19	124	49	18	89
20		55	20	90
21	81	38		96
*22	98	40	14	124
23	108	42	13	168
24	96	41	14	41
25	109	46	17	256
26	128	57	21	46
27	109	55	17	143
28	128	54	23	68
29	86	31	9	142
30	128	54	23	56
31	131	65	24	57
32	103	38	9	148
33	83	59	16	54
34	114	56	22	51
35	117	52	19	141
36	114	47	29	154
37	87	33	12	165
38	149	62	26	47
39	145	53	17	191
40	112	61	23	43
41	114	58	21	90
42	121	52	26	119
43	109	43	17	79
44	98	43		244

**Person dropped from two-way analysis
*Start of girls' scores

BIBLIOGRAPHY

Blumenthal, J. C. English 2600. New York: Harcourt, Brace, and World, Inc., 1960.

Childs, G. B. "A comparison of supervised correspondence study pupils and classroom pupils in achievement in school subjects," Journal of Educational Research, 47:537-543, March 1954.

Childs, G. B. "An analysis of the success in initial university mathematics courses of students who completed high school mathematics courses by supervised correspondence study," Unpublished manuscript, Extension Division, University of Nebraska, 1952.

Childs, G. B. and others. An Annotated Bibliography of Correspondence Study, 1897-1960. Mimeographed report, National University Extension Association, 1960.

Childs, G. B. "An analysis of certain factors which may affect completion in supervised correspondence study," Journal of Experimental Education, 32:101-107, Fall 1963

Cronbach, L. J. Essentials of Psychological Testing. New York: Harper and Bros., 1960.

Crowder, N. A. "Automatic tutoring by intrinsic programming." Lumsdaine, A. A. and Glaser R. (Eds.) Teaching Machines and Programmed Learning: A Source Book. Washington: National Education Association, 1960.

Detambel, M. H. and Stolurow, L. M. "Stimulus sequence and concept learning." Journal of Experimental Psychology, 51:34-40, 1956.

Dysinger, D. W. and Bridgeman, C. S. "Performance of correspondence study students," Journal of Higher Education, 28:387-388, October 1957.

Evans, J. L., Glaser, R., and Homme, L. E. "A preliminary investigation of variations in the properties of verbal learning sequences of the 'Teaching Machine" type," Paper read at Eastern Psychological Association, Atlantic City, 1959.

Ferster, C. B. and Sapon, S. M. "An application of recent developments in psychology to the teaching of German," Harvard Educational Review, 28, 1958

Garvey, N. F. "A study of completion records of students in correspondence courses at the University of Illinois, 1934-1946," Unpublished manuscript, University of Illinois, 1949.

Grove, Mulliken, Grove. Algebra and its use. Chicago: American Book Company, 1956.

Haberman, D. "Completion rates and achievement of students in supervised correspondence study," Master's Thesis, University of Nebraska, 1954.

Henmon, V.A.C. and Nelson, M. J. Henmon-Nelson Tests of Mental Ability. Boston: Houghton-Mifflin Company, 1957.

James, B. J. and Wedemeyer, C. A. "Completion of university correspondence courses by adults," Journal of Higher Education, 30:87-93, February 1959.

Jeffrey, H. B. et. al. "Seattle Algebra Test," Chicago: World Book Company, 1951.

Lindquist, E. F. Iowa Tests of Educational Development. Chicago: Science Research Associates, 1958.

Meyer, Susan R. "Report on the first run of a junior high school vocabulary presented in programmed textbook," Unpublished, 1959.

Murphy, D. P. First Year Algebra. Willmette, Illinois: Encyclopedia Britannica, 1961.

Parsons, T. B. "A comparison of instruction by kinescope, correspondence study, and customary classroom procedure," Journal of Educational Psychology, 48:27-41, January 1957.

Patterson, R. E. "The use of adjusting factors in the analysis of data with disproportionate subclass numbers." Journal of the American Statistical Association, 41:334-346, September 1946.

Prahl, Margaret. "A course in ninth grade English," Correspondence Study Syllabus, University of Nebraska, 1962.

Simpson, Merle. "A course in elementary algebra," Correspondence Study Syllabus, University of Nebraska, 1957.

Skinner, B. F. "Science of learning and the art of teaching," Harvard Educational Review, 24:86-97, 1954.

Smith, N. H. "The teaching of elementary statistics by the conventional method vs the method of programmed instruction," Journal of Educational Research, 55, June-July 1962.

Ward, R. N. "A study of college correspondence study completion," Master's thesis, University of Nebraska, 1954.

Wert, J. E., Neidt, C. O., and Ahmann, J. S. Statistical Methods in Educational and Psychological Research. New York: Appleton-Centruy-Crofts, Inc., 1954.

Yates, P. and De Laney, E. N. The New Building Better English (9). Evanston, Illinois: Row, Peterson, and Company, 1961.